Syllabus: WILD 541 – Research Design Lab – 1 Credit

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Office Hours: by Appointment

Lab: 2:00 – 4:00 pm WEDNESDAY via ZOOM https://umontana.zoom.us/j/6207085710

Pre-requisites: 'Ideally' some previous undergraduate classes in statistics, computer science, etc.

Course objectives: To introduce wildlife biology students to the R statistical analysis environment for the analysis of scientific data, principles of statistics and experimental design, and applications to their own individual research projects. Specifically, students will learn basic R statistical analysis methods, learn R programming skills, R data management and R graphing functions. These will be designed to expose students to elements of Research Design including probability theory, frequentist statistical approaches including t-tests, ANOVA, linear regression, sampling design, statistical power, an introduction to maximum likelihood estimators (MLE), generalized linear models and extensions, random effects models, Bayesian statistics, and learning how to assess model goodness of fit.

Required Readings: There will be no assigned textbook for this class, but it is expected that students read at least this basic introduction to R available free on the R page – I will highlight readings from this through the semester.

- Venables, W.N., Smith, D.M., and the R Core Team. 2012. An introduction to R: Notes on R: A programming environment for Data Analysis and Graphics. Version 2.15.1 (2012-06-22). http://cran.r-project.org/doc/manuals/R-intro.pdf

Because this is designed as an *INTRODUCTION* to R, you would be well served to READ some of the following FREE books I've put on MOODLE below:

1. Bolker, B. 2008. *Ecological models and data in R*. Princeton, NJ: Princeton University
2. Crawley, M. J. 2007. *The R Book*. San Francisco, CA: Wiley.
3. Zuur, A. E., Ieno, E. N., Walker, N. J., Saveliev, A. A. & Smith, G. M. 2009 *Mixed-effects models and extensions in ecology in R*. New York, NY: Springer.\
4. Kery, M., and M. Schaub. 2012. Bayesian population analysis using WinBUGS: a hiearchical perspective. Acadmic Press, San Diego, CA.
5. Chang, W. 2013. R graphics cookbook: practical recipes for visualizing data. O'Reilly, Sebastpool, CA.
6. Bivand, R. S., E. Pebesma, and V. Gomez-Rubio. 2015. Applied spatial data analysis with R. Second Edition edition. Springer, New York.

Software:
The computer laboratory portion of the class will depend on the use of the open-source statistical program R, **R-project** http://www.r-project.org/. R is free and available for download from the website

above. We will be also be using two open-source GUI's (graphical user interface) called **R-commander** available for download here: http://socserv.mcmaster.ca/jfox/Misc/Rcmdr/ and **R-studio** (http://rstudio.org/). Students will be required to install these software are also encouraged to use their own computers, but note that Hebblewhite will be teaching either on a MAC or Windows Machine, and translation between either will be up to the student. We will also download and install other R-packages through the semester.

Course Website:

Students will need active UM NetIDs to access the class MOODLE page, which should be automatically visible to enrolled students.

WBIO 541 Grades	
Lab Assignments (10)	60
Class Participation	10
Student Research Project	30
	100

Lab Assignments: Students will be required to complete 10 weekly lab assignments following key R labs through the semester. R lab assignment instructions will accompany each lab and will be due by the following lab. One of the assignments will be required to be submitted in R Markdown format, which we will learn in class.

Class Participation: this is an interactive graduate-level class, and as such, class participation through discussion, questions, leadership and co-teaching will constitute 10% of the grade for the class.

Student Project: The student project will form a key component of the joint goals of 541, and will culminate in a student designed and tailored project to explore the statistical basis of research design for their own research. Grading for this class will be based on assessment of the students submitted report, data files, R code, presentation, and data analysis (figures, tables, etc.) used in the student project report.

Tentative Schedule

WILD 541: Research Design Lab			
No.	**Date**	**Lab**	**Lab Assignment**
1	19-Aug	Introduction	Install R on your home computers
2	26-Aug	Lab 1: Intro to R Lab	No lab assignment
3	2-Sep	Lab 2: ANOVA (2-way, fixed effects, blocks)	Lab 1
4	9-Sep	Lab 3: ANOVA II (mixed-effects, ANCOVA?)	Lab 2
5	16-Sep	Lab 4: Likelihood Estimation (2 labs)	Lab 3
6	23-Sep	Lab 5: Likelihood estimation II	Lab 4
7	30-Sep	Lab 6: Population Monitoring / LS Regression	Lab 5
8	7-Oct	Lab 7: Occupancy Monitoring	Lab 6
9	14-Oct	Lab 8: Power Analysis of population monitoring and occupancy	Lab 7
10	21-Oct	Lab 9: Generalized Linear Models (Poisson, gamma - count data)	Lab 8
11	28-Oct	Lab 10: Generalized Linear Models (binary, logistic regression)	Lab 9
12	4-Nov	Lab 11: Mixed-effects generalized linear models	Student projects
13	11-Nov	Lab 12: Spatial Analyses in R	Student projects
14	18-Nov	Student Presentations	Student projects
15	25-Nov		